

**FIRST**  
**ANNUAL REPORT**

OF

**THE CHIEF ENGINEER**

OF THE

**PENNSYLVANIA RAIL-ROAD COMPANY,**

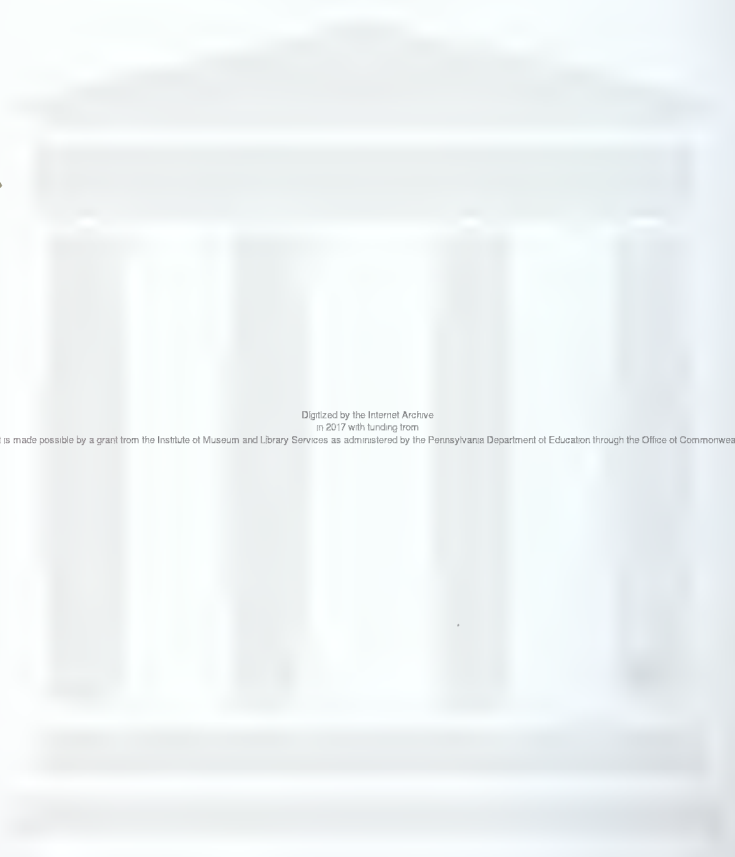
**JUNE 12, 1848.**

---

**PHILADELPHIA:**

**JOHN C. CLARK, PRINTER, 60 DOCK STREET.**

**1848.**



Digitized by the Internet Archive  
in 2017 with funding from

This project is made possible by a grant from the Institute of Museum and Library Services as administered by the Pennsylvania Department of Education through the Office of Commonwealth Libraries

# FIRST ANNUAL REPORT,

&c. &c.

---

Engineer Department, Pennsylvania R. R. Co.  
*Philadelphia, June 12, 1848.*

To the President and Directors of the  
Pennsylvania Rail-road Company,

GENTLEMEN—I have the honour to communicate to you, the following Report of the operations of this Department since it was committed to my charge, now something more than a year.

Under the organization of the Engineer Department, as adopted previous to my acceptance of the office you have conferred upon me, the Road was to be divided into three divisions, Eastern, Western, and Middle: Edward Miller, Esq., as associate engineer, was assigned to the Western, and W. B. Foster, Jr., to the Eastern division. These gentlemen had entered upon the survey of their respective lines, previous to my arrival, under instructions from the president; each with two full corps of assistants. The middle, or mountain division, not having been provided for, I concluded, after a full consideration of the subject, that the interest of the Company would be best promoted, by so far altering the organization, as to abolish it altogether, and extend the eastern and western divisions to the summit of the Allegheny mountains, the natural

boundary between them. Under this arrangement, the surveys have since been prosecuted.

The Board having directed me to cause a location of the whole line, from Harrisburg to Pittsburg, to be made at the earliest practicable period, I at once commenced a reconnoissance of that portion of the intervening country, over which it seemed—from an inspection of a map of the State, that the Road would probably pass—for the purpose of determining the best plan of operations to carry out their views.

The Legislature, in their grant to the Company, wisely left the choice of a route for the Road, between its termini, entirely free: throwing upon the Board the responsibility of selecting, upon the wide field that was opened to them, a line for their great work, which would offer the cheapest rail-road conveyance for the transportation of freight, and the most expeditious for travel, that could be selected between the west and the northern Atlantic cities.

Such a route, it was believed from previous surveys, lay within the borders of Pennsylvania; an expectation which has been fully justified by the results obtained from our examinations.

Of the several routes proposed, I found no difficulty—after a careful inspection of the plans of the various surveys, made under the authority of the Commonwealth, and my reconnoissance of the country—in coming to the conclusion, that the valley of the Juniata offered advantages for a line, which, whether we consider the low gradients that may be obtained along it, or its general directness, the desiderata required, is without a rival.

This stream has its source in the Alleghenies, and consequently severs, as it flows towards the Atlantic, all the secondary mountain ranges that lie east of them, and it heads opposite to the Black Lick and Conemaugh rivers, both of which sever

those on the west, leaving the main Allegheny only to be surmounted, which would have to be encountered upon any other *direct* route, in addition to many of the inferior mountain ranges. A more northern route, by the west branch of the Susquehanna (which has its source beyond the Allegheny mountains), would have encountered less elevation at the principal summit, but its great increased length precluded its adoption: while, on the other hand, a southern route, though not indirect, was equally objectionable on account of the rugged character of the country, and the high gradients necessary to overcome the numerous summits upon it. A partial examination of one of the proposed southern routes was made, which followed the Cumberland Valley Rail-road to near Shippensburg, and thence, crossing to the west side of the valley at Roxbury, it passed through the Blue Mountain, by a long tunnel, into Path valley; thence, following around the point of Dividing Mountain, it crossed this valley and passed through Tuscarora, by another tunnel, to the valley of Augwick creek. Thence it would have been traced between Broad Top and Sideling mountains, and up Dunning and Bob's creeks to the summit of the Alleghenies at Bob's creek Gap; or turning west by Bedford, crossed the Alleghenies at the head waters of the tributaries of Castleman's river, where the mountain is still much more elevated.

A line leaving the Cumberland Valley Rail-road at Chambersburg, and turning the end of Blue Mountain; thence seeking the low depression at Cowan's Gap in Tuscarora, would be too circuitous to compare favorably with the bolder line from Shippensburg, already described.

But that line would encounter engineering difficulties of the most formidable character: leaving out of view its objectionable gradients, and considering it in reference to its cost, and the local accommodations it would extend to a large portion of the State

—at present in a great measure deprived of the advantages of the State improvements—(the strongest argument in favor of the route,) it will be found, that equal accommodations could be extended to that region with a *less* expenditure of *capital*, by placing the main stem of the road on the Juniata, and running a branch along one of the comparatively level valleys that lie between most of the parallel mountain ranges that we pass.

The facilities that rail-roads offer, for extending their benefits to remote districts, by means of lateral lines, constitute one of their chief advantages over canals, and should prevent the error, too frequently committed in locating leading routes, of turning from a direct course to accommodate local interests to the injury of the great object intended to be accomplished.

Other modifications of the Juniata route have been suggested, and their merits fully considered, but, upon examination, all of them tended to confirm our preference in favour of the river line.

These conclusions were communicated to the Board, and the general route recommended, having been adopted by them, I proceeded at once to make arrangements to have the line surveyed throughout. For this purpose, three additional corps of engineers were organized—one for Mr. Miller's division, under the immediate direction of Mr. G. W. Leuffer, to operate on the summit and western slope of the mountain, and two upon Mr. Foster's; the first of which was placed in charge of Edward Tilghman, Esq., to whom was assigned the district between Lewistown and the confluence of the Raystown branch and main Juniata rivers.

The other corps was given in charge to S. W. Mifflin, Esq., a gentleman of well known professional skill and experience, to whom we committed the surveys of the region from the Raystown branch to the summit of the Alleghenies, embracing

the most important and difficult district upon the whole route to Pittsburg.

These parties did not take the field until the close of July, but they prosecuted their examinations with so much energy and success, that we were enabled to determine the general line of the eastern division in season to place the most difficult points upon it under contract in November of last year.

While these arrangements were in progress, the parties previously in the field were actively engaged in examining the country between Harrisburg and Lewistown.

At the instance of a number of gentlemen from Perry county, a line was tried up Little Juniata creek, leaving the Susquehanna at Petersburg, thence near Bloomfield and along Sherman's valley to Concord gap, where it passed the Tuscarora mountain, thence it followed Tuscarora valley to Shade creek, and down that stream to Augwick creek, along the valley of which it was carried to Drake's ferry on the Juniata. The advantage promised for this route was a considerable saving of distance. The result, however, demonstrated that not only would we have had to encounter gradients running up as high as sixty feet per mile, but the length of the line would be increased four miles by its adoption. It was consequently abandoned.

After a careful examination of the country bordering on the Susquehanna and Juniata rivers, a line has been located as far up as Huntingdon, which is believed to be the best that can be obtained.

If the valleys of these streams had not been pre-occupied by other improvements, a route would have been selected differing somewhat in its details from that adopted. Even for the short distance that we are brought into close proximity with them, the cost of the grading of the Road has been greatly enhanced by the confined ground we have been forced upon.



The located line commences at the Harrisburg and Lancaster Rail-road depot; thence, passing through Harrisburg, it follows the sloping ground between the canal and the capitol ridge four miles; when it crosses the canal, and touching the point of Blue mountain, recrosses and passes to the west side of the Susquehanna river by a bridge 3660 feet in length, and 44 feet above low water at grade line, which enables us to place the road on the top of the bridge. Thence we pursue this bank of the river through the villages of Duncannon and Petersburg to the Juniata, along the southern side of which, it is continued through Newport and Perrysville to a point a short distance above Lewistown. Here the line crosses to the north side of the river, and within a short distance recrosses, to save nearly a mile of road, and one hundred and eighty degrees of curvature, together with some difficult ground along the bluff shores on the south side of the stream.

After regaining the southern side we follow the river slopes, over favorable ground, to Mr. Harvey's, about seven miles above Waynesburg, where the line again crosses to the north side, and passing back of Newton Hamilton, cuts through the neck of land in the great bend of that stream, 40 feet in depth at the summit, and 3100 feet in length at grade. Descending along the eastern slope of the river, we once more cross it at Shaef-fer's aqueduct, and continue upon its south-western bank through Jack's narrows, without meeting any serious difficulties; and finally pass to its north side, along which it is continued through Huntingdon to the Little Juniata, above Petersburg. Above Huntingdon, a preliminary location has been carried up the Little Juniata to Logan's narrows, at which point this stream divides Bald Eagle and Brush mountains in its passage from Tuckahoe valley.

Along the Little Juniata, from Dorsey's forge to the Narrows, the line encounters much difficult ground, owing to the



circuitous character of the stream, and the high hills and mountains which bound its course. To obtain a route, with easy curves, we are forced, within this distance, to tunnel the point of Tussey's mountain, and to cross the river twelve times. To follow the line recommended by Mr. Schlatter through this region, curves of 400 feet radius would have had to be resorted to, which I deem wholly inadmissible upon a road of the importance of that you have in view.

At Logan's Narrows we reach the valley that skirts the whole eastern base of the Allegheny mountains. Here it becomes necessary to determine the plan to be adopted to overcome the great barrier that separates us from the West. If it is to be surmounted by a road, with the gradients of the western division, the ascent must commence at this point, and gradually wind its way to the summit, by an almost continuous gradient along the declivities of the mountains for nearly thirty-two miles, crossing the several streams that issue from it, by high bridges, and cutting through or tunneling their dividing summits.

Mr. Schlatter, in his Report to the Canal Commissioners, estimates the cost of grading the road, on this ascent, at \$1,496,146, which I consider too low for a line, with the gradient he adopted, but with the increased maximum grade found necessary on the western division, and a somewhat lengthened line, it would probably prove sufficient.

Upon my first reconnoissance of this portion of the country, it occurred to me that its peculiar topographical features were lost sight of in the adoption of this plan of ascent, which seemed to look to the single object of obtaining a line with a particular gradient, without regard to the magnitude of the obstacles to be overcome to procure it; while, by pursuing a course from the Narrows, nearly in a direct line to Sugar Run Gap, (which we shall hereafter show is the best point to cross the mountain,) the line would pass through a beautiful valley,

over, comparatively, favourable ground, gradually gaining elevation through its whole course, without exceeding the maximum inclination required on the line below, until it reaches the summit of the valley at Robinson's, a distance of fifteen miles. At this point we attain an elevation of 1174 feet above tide, leaving but 980 feet to be overcome to reach the height found most suitable for passing the mountain; which is attained by a continuous gradient of 80 feet per mile, encountering no *very* formidable difficulties.

A resort to a gradient of 80 or more feet per mile, is by no means an unusual expedient on leading rail-roads.

Upon the Western Rail-road, in Massachusetts, their maximum gradient is  $83\frac{1}{2}$  feet per mile. On the Baltimore and Ohio Rail-road, they now have, between the waters of the Patapsco and Potomac, on each side of Parr's ridge, gradients of 82 feet per mile; and from the greater elevation of the Allegheny mountain at the place they must cross, it is to be presumed that their gradients at that point will still be increased to a higher rate.

Many other instances might be cited, some running up to 120 feet per mile; but it seems unnecessary to extend the list. Theoretically, the power necessary to overcome a given height, is the same at all inclinations of the plane of ascent; but in practice, it is to some extent dependent upon the kind of power to be applied.

In the case under consideration, the locomotive steam engine will be the medium used, where the power is carried with the train, and forms part of the load to be moved; consequently the cost of power on a plane ascending 80 feet per mile, is greater than upon one of a more moderate inclination of equal height, by the difference between the gravity of the engines required to carry the same load on both planes.

As a general principle, this would be true when the lengths

of the roads to overcome the same height are equal, and it is necessary to carry the locomotives, required for the high gradient, over the same distance that they must run upon the low gradient.

But in one of these cases, the maximum gradient due to the line below Logan's Narrows, is carried to within  $12\frac{1}{4}$  miles of the summit of the mountain—requiring extra power for that distance only—and in the other it ends 32 miles from it.

To explain more fully the relative value of the maximum gradients used on the different divisions of our Road, I have prepared the following table:—

Division of Road.	Maximum Gradient, ascending westwardly, per mile.	Maximum Gradient, ascending eastwardly, per mile.	Gross load of a 20 ton freight locomotive, exclusive of engine and a tender of 10 tons. Friction $8\frac{1}{2}$ lbs. per T. Adhesion $\frac{1}{3}$ .	Load of merchandise for a 20 ton freight engine, the cars being estimated at 4 thirds of their weight and load.	Relative load of locomotive on each gradient, level being unit.	Number of locomotives of equal power, necessary to carry the same load up each gradient.
From Harrisburg to Lewistown, 60 7-10 miles.	16		346.6	207.9	0.534	1.87
		8	454.3	272.6	0.697	1.42
From Lewistown to foot of Allegheny Mts., 72 miles.	21		300.7	180.4	0.464	2.15
		$10\frac{1}{2}$	414.6	248.8	0.640	1.56
From foot to summit of Allegheny Mountains, 12 3-10 miles.	80		105.6	63.4	0.163	6.13
		Level.	648.0	388.8	1.000	1.00
From summit to Pittsburg, 106 miles.	47		172.4	103.4	0.266	3.76
	50	50	163.7	98.2	0.252	3.95
	52.8	52.8	156.2	93.7	0.241	4.14

It will be perceived, from the foregoing table, that three locomotives are fully sufficient to transport the same load up the 80 feet gradient that two will carry on the gradient of the western division, and one on the eastern: hence the practical working of the road on the two methods of ascent would be, to run two locomotives with the load brought from below, from Logan's Narrows to the summit, say  $31\frac{3}{4}$  miles up the 50 feet gradient; while, on the other, the same engine that brought the load from Harrisburg would continue with it to Robinson's, (15 miles,) where it would accompany the two destined for Pittsburg to the summit of the mountain and return.

In the first case, the engines together, will have traveled  $63\frac{1}{2}$  miles, and in the other, the three,  $51\frac{3}{4}$ , leaving a difference in distance to be traveled by the moving power due to each full train, from the east,  $11\frac{3}{4}$  miles in favour of the 80 feet gradient.

In practice it will therefore be seen—chiefly on account of the actual distance saved—that transportation can be afforded cheaper, in this case, on the 80 feet gradient than on the 50, without bringing into the estimate the interest on \$841,000, that the latter would cost to obtain it, more than the former. Under these circumstances we did not hesitate, when the choice of routes was reduced to a selection between these two methods of overcoming the mountain, to decide in favor of the line by Robinson's, which has the additional advantage of bringing us within  $6\frac{1}{4}$  miles of Holidaysburg, where a connexion may be made with the Allegheny Portage by a branch line, passing over favorable ground.

The distance from Harrisburg to Robinson's summit is  $132\frac{2}{3}$  miles: upon the whole of this line, the only extraordinary impediments to the easy graduation of the road bed, are the bridge over the Susquehanna, a deep and long cut near Newton Hamilton, and a tunnel 1200 feet in length through a point

of Tussey's mountain; and in this distance the maximum ascending gradient to Lewistown is 16 feet per mile, and descending 8 feet. Thence, to Robinson's summit, they are increased to 21 feet, ascending, and  $10\frac{1}{2}$  descending.

The descending gradients are generally so short that they will not be found, in practice, to decrease the load going east, much below what is due to a fair *working* load for a locomotive on a level.

The maximum ascending gradient above Lewistown, is determined by the deep cut near Newton Hamilton. The ascent of the Little Juniata seems, however, to require—to obtain an economical line—the use of this inclination, without much intermission, from Dorsey's forge to Robinson's summit. Below Lewistown the gradients are fixed to accommodate the increased trade that would fall upon the line between that place and Harrisburg, without increasing the number of trains.

These low gradients insure to us the important advantages of a single pair of drivers for the passenger engines, upon the eastern division; and, with these rates of inclination, we are enabled to make the line conform to the natural features of the country, (above high water mark,) without decreasing the curvature below 955 feet radius, except at the east end of the Susquehanna bridge, where a radius of 880 feet has been admitted.

All of our efforts to save distance, by deviating, temporarily, from the immediate valley of the river, involved either the use of high gradients, not justified by the distance saved, or an increased cost that was equally unwarranted. The beautiful valley of the Kishacoquillas offered the greatest temptation to leave the river route; but here we would have had to encounter gradients, in both directions, of  $26\frac{4}{10}$  feet per mile, a bridge over Mill creek, 1200 feet long, 111 high, another over a small tributary of the Juniata, 850 feet long and 150 feet in height, together with several others, or embankments of great magni-



tude, across ravines in the north slope of the river hills. These difficulties, added to 342 feet of additional elevation to be surmounted at the Allentown summit, so greatly overbalanced the small increase of curvature and distance, ( $\frac{7}{10}$ ths of a mile,) by the river route, that it could not be adopted. It was also ascertained, that by the *use of the maximum gradients* required on the valley route, the shortest line could have been procured by the river, and at the least cost. A fact, conclusive in itself, as to the proper route.

I deemed it unnecessary to make further instrumental examinations of the Stone mountain route, feeling satisfied, that even if a line could be obtained in that direction, which would approximate to an equality, in an engineering point of view, with the route selected—which, from a reconnoissance of a portion of the line, and an examination of the plots of Mr. Schlatter's surveys, I should consider *quite* improbable—that its additional cost would entrench so much upon the means of the Company as to place it entirely out of the question.

A line was traced from Huntingdon to the Frankstown branch of the Juniata; below Williamsburg, across Tussey's mountain, by which a saving of distance could have been made nearly equal to the Stone mountain route, but its high gradients, cost, and the length of time that it would require to build the road over it, rendered it equally objectionable. The valley of the Frankstown branch was also surveyed; the route by it, joining the Little Juniata line at Robinson's ridge, but it proved both longer and more expensive than the latter. The searching examinations made, of the whole region offering any chance for a more practicable route, on the north or south of the Juniata, leaves no doubt upon my mind but that the best line has been procured for the eastern division. Its comparatively easy curvature and low gradients, adapted in their inclination to the direction of the largest business, and extending



from the eastern terminus of our Road to the foot of the great barrier that divides us from the west, give it advantages that are not equalled by any other route proposed, between the east and west, and cannot be too highly appreciated by the Company.

Before determining the point to pass the mountain, a full examination of its crest was made, from Cedar Swamp summit on the south, to Three Springs Gap at the head of Moshannon creek on the north, embracing a distance of 44 miles. The following table will show the elevation, above tide, of each summit within that distance; also, that at Emigh's Gap, on the northern route, and at the head waters of Castleman's river on the southern.

*Tabular Statement of Depressions of Allegheny Mountain.*

Name.	Waters Divided.	Authority.	Feet above Sugar Run Gap.	Feet below Sugar Run Gap.	Feet above Tide.
Summit of Chesa. & Ohio Canal,	Castleman's and Potomac.	U. S. Engineers,	476		2759
Albright's Summit,	Do. do.		141		2424
Sand Patch do.	Do. do.	J Knight,	129		2412
Chambersburg and Pittsburg Survey,		H. Hagé,	264		2547
Cedar Swamp Gap,	Raystown Branch of Juniata and S. Fork of Conemaugh,	S. H. Long,	160		2443
Bob's Creek do.	Raystown B. and Conemaugh,	Do.	213		2496
Big Spring do.	Juniata and Conemaugh,	Do.	314		2597
Laurel do.	Do. do.	Do.	222		2505
Adams do.	Do. do.	Do.	175		2458
Portage and Summit,	Juniata and Clearfield,	C. L. Schlatter,	41		2324
Sugar Run Gap,		S. H. Long,	0		2283
Burgoon's do.	Do. do.	C. L. Schlatter,	89		2363
Kittanning do.	Do. do.	Do.	75		2358
Dry do.	Do. do.	Do.	67		2350
Hamer's do.	Little Juniata and Clearfield,	Do.	177		2460
Schultz do.	Do. do.	E. Miller,		17	2265
Cock Run do.	Do. do.	Do.		55	2298
Maple do.	Do. do.	Do.		61	2292
Bell's do.	Do. do.	Do.		12	2271
Three Springs Gap,	Little Juniata and Moshannon,	Do.		53	2230
Emigh's do.	Do. do.	C. L. Schlatter,		240	2043

It will be perceived, that the lowest point in the mountain, except at Emigh's, is Maple Gap, from which issues Bell's Run, (a branch of the Little Juniata,) on the east, and Sandy

Run of Clearfield, on the west. This point is 61 feet below Sugar Run Gap, and could be further reduced 150 feet, by a tunnel 700 yards in length. If the ground had been favorable beyond the summit, this route would probably have offered the greatest advantages to cross the mountain, but it opens westwardly upon the deep valley of Clearfield, a descent into which would involve the necessity of a resort to as steep a gradient on the west side of the mountain as that required on the east; and the elevation thus lost would have to be regained by following up the valley to Laurel Swamp or Munster summits, in the ridge that separates Clearfield from the Conemaugh, which is here the true back bone of the country.

Any attempt to carry a line along the west slope of the mountain, to avoid the descent to Clearfield, would, from the rugged character of the ground, prove impracticable, without a vast increase in its cost, length and curvature. No other point offers equal advantages to cross the mountain until we reach Sugar Run Gap, which is 41 feet below the Portage Rail-road summit, and may be reduced 120 feet more by a tunnel 2000 feet in length. Emigh's Gap, which is still lower than Maple Gap, could not, on account of its gradual slope, be reduced by a tunnel of moderate cost, and it is also too far north for a direct route to Pittsburg. South of the Portage the Alleghenies become the water shed of the Union, dividing the streams that flow into the gulf from those that empty into the Atlantic. They here assume a more elevated character than while separating only the tributaries of the Susquehanna, affording no opportunity to pass them by a line adapted to locomotive power—unless by a tunnel of immense extent—until we reach Bob's Creek Gap. The accompanying profile, which exhibits the crest line of the mountain, (for 44 miles,) will give a more definite idea of the relative height of these summits.

The mountain, on each side of Bob's Creek Gap, rises to a

considerable height, making it appear, to a casual observer, a very deep depression; and, from this circumstance, it has generally been considered, by the residents of the adjoining country, to be the lowest pass in the Alleghenies; and, as it falls off rapidly on either side, it has also been supposed that it could be farther reduced by a tunnel of moderate extent. The several surveys of the mountain, however, prove it to be 212 feet higher than Sugar Run Gap; and, to reduce it to a level with the surface of the ground, at the latter point, which is 120 feet above the grade of the adopted line, it would require a tunnel  $1\frac{1}{4}$  mile in length, to be constructed under very disadvantageous local circumstances.

Cedar Swamp Gap, still farther south, is 53 feet lower than Bob's Creek Gap, but it falls off on each side so gradually that it could not be reduced conveniently more than 40 feet.

Neither of these points, therefore, which are the only passes worthy of notice south of the Portage Rail-road, that lie within the region over which a direct line to Pittsburg must necessarily traverse, afford depressions that will compare favorably with those farther north; nor does the ground leading to them, east or west of the mountains, offer equal facilities to obtain a line of uniform ascent to the summit. The distance from the Conemaugh is too short to overcome the elevation with the gradient used on the western division; and, from the Juniata, the greater height to be ascended would continue the line so long upon the mountain steeps, that it would be exceedingly expensive to procure a road-bed with a gradient even higher than 80 feet per mile.

From the foregoing description of the most favorable mountain passes, it will be seen that Sugar Run Gap offers the greatest facilities to cross the Allegheny.

It now becomes necessary to consider, in what direction the Road can be carried thence to Pittsburg. From an inspection

of a map of the State it will be seen that a straight line, drawn from this gap to Pittsburg, will fall on Munster, Beulah, and follow the valley of Black Lick, for nearly its whole extent, and intersect the Conemaugh near Blairsville; thence it crosses the country lying within the elbow formed by the Kiskemintas and Allegheny rivers; passing the Loyalhanna and Crabtree waters, and following, generally, the high and broken ridge parting the Allegheny and Monongahela rivers. That line, which would approximate most nearly to this course, would—all other things being equal—be the most desirable for the Road.

The operations of the different corps, on this division, have been confined to surveys that were necessary to determine the point of crossing the mountain and to the regions between the Conemaugh and Pittsburg, west of the Chesnut ridge. Our examinations have not yet been sufficiently extensive to enable me to give a full description of that part of the country between the mountain and Blairsville, and I shall therefore leave it for a future report, with the simple remark, that, from the information before me, I am satisfied that a practicable line may be obtained by the valleys, either of the Black Lick or Conemaugh, within the maximum gradient used upon the western division.

The district of country over which it will be necessary to carry the road from the Conemaugh to Pittsburg, is one of remarkable intricacy. It lies wholly within the coal measures, and has, at some period, evidently been nearly a level plane of vast extent, covered by the ocean. The discharge of the waters from this wide spread field seems to have been sudden, forming numerous circuitous channels in every direction, cutting deeply into the soft horizontal strata of this region, in their descent to the tributaries of the Ohio, leaving the intervening ridges washed into so uneven a surface as to render the

passage of a rail-road along them entirely out of the question. A line following the Conemaugh—which bears north-west from Blairsville—to the Allegheny, would avoid this difficult country, but the length of the route would be increased fully 50 per cent. and it is, therefore, inadmissible.

A route, with higher gradients than those adopted on the Juniata, throughout this division, seems to be called for by the topography of the country.

In his report upon the western division, Mr. Miller gives the following account of the surveys, conducted under his direction, by Messrs. Day and Pemberton, his principal assistants.—“If a straight line be drawn from Blairsville to Pittsburg, it will be seen that Turtle creek is the only stream that approximates to the proper course of the road, whilst the Loyalhanna, the chief tributary of the Conemaugh, crosses it nearly at right angles, and Spruce Run, Roaring Run, Porter’s Run, Beaver Run, and others, intersect it at various angles of obliquity. Much time and labour were bestowed by Mr. Schlatter and his principal assistant, Mr. Roebling, upon the investigation of this district; and their maps and profiles, loaned to us by the Canal Commissioners, have been of much service in our examinations. From a careful investigation of Mr. Schlatter’s preferred route on the ground, it appeared possible to avoid some of the most formidable obstacles which he encountered, by adopting a higher gradient than his maximum of 45 feet per mile, and by a reasonable increase of distance at a few points.

“Our trial lines confirmed this, and, in the location made, a maximum of 1. in 100, or  $52\frac{8}{10}$  feet per mile, has been used at several places. The cheapness of fuel throughout the whole extent of the western division renders this increase of gradient less objectionable than elsewhere; bituminous coal, of the best



quality, is every where abundant, and can be delivered at the depots at from 56 to 84 cents per ton."

The principal changes made in the route referred to, in Mr. Schlatter's report, Mr. Miller describes as follows:

"Upon the White Thorn our line keeps the left bank, entirely to its mouth, avoiding a tunnel of 600 feet, leading into the valley of Buck Run, and a high bridge over White Thorn creek, and reducing that over the Loyallhanna, from 90 to 50 feet in height. West of Buchanan's summit, we run level round the hill, between Porter's Run and Beaver Run, avoiding the Still House summit entirely, where a tunnel of 1000 feet was proposed, with a cut of 70 feet at its western end, running out to grade in a distance of 1700 feet.

"Passing Burnt Cabin summit, by a deep cut, the line descends along Turtle creek to the Monongahela.

"Below Murrys ville the creek makes a double bend, like the letter S. The former line crossed one of these bends, by a tunnel 600 feet long, whilst ours crosses the other by a short deep cut, following a remarkable pass by which the hill is nearly cut through. These changes have reduced many of the deep cuts, avoided several bridges, saved three tunnels, and reduced the length of a fourth, amounting in all to a reduction of 2300 feet of tunneling."

After reaching the Monongahela, two routes present themselves, one following the bank of the stream to Pittsburg, and the other ascending along the slope of the river hills, enters a valley leading by Wilkinsburg and East Liberty. Thence, following this valley, it descends Two Mile Run, and enters the city on the Allegheny side. The latter, though the longest route, and requiring gradients of 50 feet per mile, has been adopted, as it presented the only apparently feasible route by which a connexion could be formed with a road extending towards the great West.



The comparative cost of grading and damages, upon the two lines, would be rather in favor of the route adopted.

A line has also been located from the junction of Turtle and Bush creeks; which passes up Bush creek and through Greensburg to Bernhard's summit, thence by the valleys of Fourteen Mile Run, Sauxman's and Magee's Runs, to the Conemaugh, at the gap through Chesnut ridge.

If the Conemaugh route, by Johnstown, should be adopted, the line by Greensburg will be about  $3\frac{3}{4}$  miles longer than that by Turtle creek, but passes east of the Loyalhanna, over much more favorable ground than any other line examined.

Its advantages, in relation to the local trade of a rich and populous section of country, west and east of Chesnut ridge, through the gap formed by the Loyalhanna, give it strong claim for consideration.

Whether the increased length of the line, and the difficulties west of Greensburg, will be sufficient to counterbalance these local advantages, we will leave undecided until the comparative estimates have been fully made out. Another line was traced, leaving Greensburg and passing into Ligonier valley, through Chesnut ridge, at the Loyalhanna Gap, thence north of this ridge along Coal-pit and Kendrick's Runs, to the Conemaugh, which resulted unfavorably.

Further examinations will be made through Ligonier valley, striking the Conemaugh higher up. The Black Lick and the country between it and the Conemaugh will also be examined during the season.

The following summary statement will exhibit the estimated cost and distances of a continuous rail-road from Harrisburg to Pittsburg, via Johnstown and Blairsville, graded for a double track, and a single track and turnouts laid.

The estimate is based upon prices that are believed to be ample to finish the road in a substantial manner. If the work

should be pushed with *cautious energy*, it may be completed for a somewhat less sum.

The width of the road-bed at grade line in thorough cuts of earth is 32 feet, in rock 26 feet, and on embankments 25 feet.

Items.	Places.	Dist. in Miles.	Cost. Dollars.
Graduation,	Between Harrisburg and Lewistown,	60.70	705,610
	„ Lewistown and Huntingdon,	36.70	582,342
	„ Huntingdon and Robinson's,	35.20	703,000
	„ Robinson's and Sugar Run Gap,	12.25	655,000
	„ Sugar Run Gap and Johnstown,	28.50	875,000
	„ Johnstown and Blairsville,	28.	445,000
	„ Blairsville and Brush Creek,	33.	925,000
	„ Brush Creek and Pittsburg,	15.	145,000
	Amount,	249.35	5,035,952
	Superintendence, &c.,		250,000
	Contingencies,		350,000
Superstructure, {	Single track, including an average of 450 feet of turn-outs, per mile,		2,792,722
	Interest account,		551,000
	Land damages and fencing,		170,326
	Grand total,		9,150,000

That part of the line below Huntingdon has been located permanently; thence to Logan's Narrows the calculations are based upon a preliminary location; and between this point and Blairsville, upon an experimental survey, with liberal allowances for contingencies. Between Blairsville and Pittsburg the road has been carefully located. Upon that portion of it, between Blairsville and Turtle creek, gradients of  $52\frac{8}{10}$  feet per mile have been admitted, which may be reduced to 50 feet per mile, by the expenditure of an additional sum of \$40,000.

Our measurement of distances commence at the depot of the Harrisburg and Lancaster Rail-road Company,  $106\frac{3}{4}$  miles from the corner of Vinc and Broad streets, in the city of Philadelphia, and terminate at the intersection of Liberty street, in the city of Pittsburg. Those made for the Commonwealth,

under the direction of Mr. Schlatter, began at State street, in Harrisburg, and ended at Two Mile Run, on the Monongahela river, giving a difference in favor of Mr. Schlatter's line of about  $1\frac{8}{10}$  mile in the points of starting. Between Blairsville and Pittsburg our distance has been actually increased  $2\frac{8}{10}$  miles over that proposed by Mr. S., after making allowance for about  $\frac{6}{10}$ ths of a mile of an unaccountable discrepancy in the two measurements. This increased distance is incurred to save three tunnels, and other expensive work, amounting, together, to \$280,000 or \$100,000 per mile.

The whole difference between Mr. Schlatter's and Mr. Miller's measurements, supposing the points of starting and ending to have been the same, is  $4\frac{3}{10}$  miles. The difference between the points of starting of the two surveys, on Mr. Foster's division, is about  $\frac{2}{10}$ ths of a mile. From Harrisburg to Huntingdon we lose, by following the river route,  $\frac{7}{10}$ ths of a mile\* on Mr. Schlatter's line, and save, from thence to the summit of the mountain, about four miles.

As a connexion with the Allegheny Portage Rail-road would insure to us most of the advantages of an independent road to the western base of the mountain, it is evidently the policy of the Company to make it at the earliest practicable moment. Our location falling within  $6\frac{1}{2}$  miles of that road, it becomes a very small matter to effect a junction with it. If the present means of the Company, however, would justify the expenditure, the connexion could readily be made at the foot of Plane No. 4, on the west side of the mountain, thus saving 7 out of 10 of the inclined planes. This could be effected for the additional sum of \$1,250,000; or for \$950,000, a junction might be made at the summit of the Portage, avoiding the five eastern planes.

\* By an alteration of the line, since made, the distance lost by the river route is reduced to four-tenths of a mile.

The branch to, or above Hollidaysburg, is however, the cheapest and most speedy way of effecting the connexion; and when our road is carried over the mountain it will remain a good feeder to the main line, and a fair investment of the capital of the Company.

The following is an estimate of the cost of a continuous road from Harrisburg to Pittsburg, in connexion with the Allegheny Portage Rail-road, graded for a double track throughout, except the branch to Hollidaysburg.

Graduation,	{		Miles.	
		From Harrisburg to Robinson's,	132.67	\$1,990,952
		„ Robinson's to Hollidaysburg,	6.33	32,000
		„ Hollidaysburg to Johnstown,	36.67	
		„ Johnstown to Pittsburg,	76.00	1,515,000
		Total,	251.67	3,537,952
		Superintendence and Contingencies,	-	419,754
Superstructure,		Including turn-outs, on 215 miles,	-	2,408,000
		Cost of Road,	-	\$6,365,706
		Interest account,	-	450,000
		Land damages and fencing,	-	154,294
		Grand total,	-	\$6,970,000

To the above amount should be added, for the purchase of Depôt grounds, erection of warehouses and shops, and the construction of cars and locomotives, as follows:

Warehouses, including ground at Depôts,	\$475,000.00
Shops and Machinery . . . . .	185,000.00
Locomotives, . . . . .	510,000.00
Passenger and Burden Cars, . . . . .	820,000.00

Total, . . . \$1,990,000 00

Making the whole cost of the Road, graded for a double and a single track laid, including outfit, \$8,960,000.00.

It will not be necessary to expend the whole of this amount until some time after the Road is in use to Pittsburg. As the

business increases the turn-outs must be lengthened, depôts and shops enlarged, and the number of locomotives and cars added to. These will not reach the sum estimated, until probably, four years after the Road is completed, in connexion with the Allegheny Portage. We shall also reduce the cuttings and embankments to a single track width, wherever the character of the excavations, or a deficiency of material for embankment will justify the curtailment; this will effect a saving, in the first outlay, of about \$450,000, which will not be required until the business demands a double track.

The expenditure for the outfit, when the Road is opened through, will not exceed \$1,340,000, leaving \$650,000 of the estimate, for this item, to be disbursed, after the Road is finished, to meet the demands of the increased business for the *time* stated.

This will leave the cost of the Road and outfit, when opened for use, in connexion with the Portage Road to Pittsburg, as follows:

Cost of Road, with single track and turn-outs,	
as estimated, . . . . .	\$6,365,706.00
Less estimated cost of unfinished grading required to prepare the Road for a double track, . . . . .	450,000.00
	<hr/>
Leaving cost of grading and superstructure of Road, . . . . .	5,915,706.00
To this add interest account, . . . . .	\$450,000
And land damages and fencing, . . . . .	154,294
	<hr/>
	604,294.00
Also, cost of Locomotives, Shops, Depôts and Cars, . . . . .	1,340,000.00
	<hr/>
Total, . . . . .	\$7,860,000.00

The Board having wisely determined in no event to enter into engagements beyond their ascertained means, I have thought it best, thus early, to present an estimate of the cost of the whole work for their guidance. It will be recollected, that the estimate for the grading is made, in part, upon experimental surveys, with full allowances for contingencies. By the close of the year we hope to be able to give an estimate of the whole Road, in detail, from actual location, which may show a somewhat reduced cost.

Under the contemplated connexion with that road, the Allegheny Portage becomes an important part of our line; and, for the information of the Board, I insert the following description of it, extracted from a pamphlet written by S. W. Roberts, Civil Engineer.

“The Portage Rail-road consists of eleven levels, or graded lines, and ten inclined planes. The ascent from Johnstown to the summit is 1171.58 feet, in a distance of 26.59 miles; and the descent, from the summit to Hollidaysburg, is 1398.71 feet in a distance of  $10\frac{1}{10}$  miles. There are five inclined planes on each side of the mountain, varying, in inclination, from  $4^{\circ} 9'$  to  $5^{\circ} 51'$ , or from 7.25 feet to 10.25 feet elevation to each 100 feet base. They are numbered eastwardly, the one nearest Johnstown being No. 1; that nearest Hollidaysburg, No. 10. The following table shows the length, rise, and fall of each ‘Level’ or grade line, and each inclined plane.”



			Feet.
Level No. 1,	From Johnstown to Plane No. 1,	4.13 miles,	Rise, 101.46
Plane 1,	Ascending,	1607.74 feet,	150.00
Level 2,	Long Level,	13.06 miles,	189.53
Plane 2,	Ascending,	1760.43 feet,	132.40
Level 3,	"	1.49 miles,	14.50
Plane 3,	"	1480.25 feet,	130.50
Level 4,	"	1.90 miles,	18.80
Plane 4,	"	2695.94 feet,	187.86
Level 5,	"	2.56 miles,	25.80
Plane 5,	"	2628.60 feet,	201.64
Level 6,	Summit of Mountain,	1.62 miles,	19.04
Total rise,			1171.53

			Feet.
Plane No. 6,	Descending,	2713.85 feet,	Fall, 266.50
Level 7,	"	.15 miles,	0.00
Plane 7,	"	2655.01 feet,	260.50
Level 8,	"	.66 miles,	5.80
Plane 8,	"	3116.92 feet,	307.60
Level 9,	"	1.25 miles,	12.00
Plane 9,	"	2720.80 feet,	189.50
Level 10,	"	1.76 miles,	29.58
Plane 10,	"	2295.61 feet,	180.52
Level 11,	To Hollidaysburg,	3.72 miles,	146.71
Total fall,			1398.71

In conformity with resolutions of the Board, eighteen miles of the grading on the eastern, and fifteen on the western ends of the Road were placed under contract in July last. In November the contracts upon the eastern division were extended to Lewistown, and on the 17th ult., to Huntingdon, together with a few miles of heavy work along the Little Juniata, embracing altogether 106 miles.

Very little of the grading, on the western division, has been executed, as there appeared to be no sufficient reason for pressing that portion of the Road until the means of the Company would justify a larger expenditure upon it than they have heretofore.

The work upon the eastern division has been retarded from the scarcity of labor. Time seems to be required to collect the necessary force upon the line. With the exception, however, of the Susquehanna bridge, the grading will be prepared

for the superstructure, to Lewistown, this year. The masonry of that important job was first allotted to contractors: the principal of the firm, though highly recommended by the officers of the Reading Rail-road, proved unequal to the task he had undertaken, and their contract was abandoned. In consequence, the remnant of last season, after the contract was let, was mostly lost.

The work has been re-let to Holman, Simons and Burke, who have carried it forward satisfactorily. The prevalence of high water, since the season for laying masonry commenced, has prevented as much progress, at this time, as could have been desired; but we still entertain hopes that it will be completed before the ensuing winter. If this is accomplished, the Road can be opened to Lewistown next spring. Under any ordinary circumstances, it will be finished to Huntingdon ( $98\frac{1}{2}$  miles) by the close of navigation in 1849—a point as low down as we may anticipate a profitable use of the Road from.

Our arrangements have been made with a view to the completion of the Road to the Allegheny Portage, early in the spring of 1850. An earlier period could not be fixed, owing to the magnitude of some of the work on the Little Juniata; a portion of which, embracing the tunnel, through a point of Tussey's mountain, was located and contracted for last December, to avoid delay and a premature expenditure of capital on the lighter work, which would have followed a general letting of the whole Road at that time, or since, even if it could have been prepared for contract in season.

If sufficient means shall be obtained to prosecute the western division, I would recommend that the heavy portions of the work, between the Conemaugh and the confluence of Brush and Turtle creeks should be placed under contract, together with the grading, continuously from the Portage road to the

point of divergence of the line from that river towards Pittsburg, if the Conemaugh route is adopted.

When the connexion is made with the Portage Rail-road, from the east, there will then be a continuous rail-road from Philadelphia to Johnstown, 282 miles in length; and if opened, at the same time, to near Blairsville, it will be extended to 310 miles, with only 43 miles of turnpike thence to Pittsburg, or 75 miles of canal navigation; giving a line of communication, with the Ohio river, far superior to any rail-road route existing, or any that will at that time be built. On freight destined to the interior of Ohio, but one transshipment will then be necessary. The canal boats, loaded at the terminus of the Road, can be conveyed to any point upon the Ohio Canal.

If your Road possessed no other source of revenue than the local travel and transportation of the rich and populous region to be traversed by it—secured, as it will be, from competing lines, by *natural barriers* stretching out on either side from the Susquehanna to the Potomac—they would be sufficient to justify its construction. The influence of the Pennsylvania Canal has called into activity all the elements necessary to render the enterprise profitable, and, in consequence, it will be more successful with that improvement, as a pioneer rival, than if it was now to enter upon an unoccupied field. Whatever may be the effect of your work upon the business of the canal—and I do not believe it will be injurious—there can be no doubt but that it will add very materially to the revenues of the Commonwealth.

Important as the local sources of revenue are to the Company, they will afford but a limited amount of business compared with that to be derived from the great West. The route of your improvement is directly on the line that would be most desirable for a rail-road to pass from St. Louis, or the confluence of the Mississippi and Missouri rivers, through the cen-

tre of the wealth and enterprise of the Mississippi valley to the Atlantic. With a map of the Union before you, it will be found to be impossible to draw a line upon it that would accommodate so large an amount of population, or an equal extent of fertile country.

Through the broad bed of mountains that divide the Atlantic from the Western States—traversed by our route for 190 miles—natural gorges are found, cutting all of them to their bases, except the Allegheny, which is passed with comparatively easy gradients, and without encountering difficulties of a very unusual character. These favorable features of the country give to us a line which is the shortest and best that can be obtained between these sections of the Union, and insures to the Company the whole of the travel and light transportation, with much of the heavy trade, destined to Philadelphia, and points north of this city, of the vast region between a line along the southern shores of Lake Erie, touching Lake Michigan, and extending to the far West, and the immediate valley of the Ohio river. The distance from Cleveland to New York being 80 miles shorter, by this route, than by the New York and Erie Rail-road, much of the travel embarked upon the lakes, for that city, from the north and west, must also be diverted to this line.

In view of these circumstances, can a reasonable doubt be entertained by any one, as to the profitableness of the stock of the Pennsylvania Rail-road Company? Its natural position must give to it more than sufficient business to make it yield large profits. Indeed, I confidently advance the opinion, that when the Road shall have been completed, that it will not be a question, “whether it will pay an interest on its cost,” but to what point the rates of freight and passage shall be reduced, to give to the Company ample revenues, and at the same time make the work most extensively useful to the public.

Dividends from its revenue can be made of 6, 8, or 10 per cent. by changing the rates of freight and passage, at the discretion of the Directors.

From some experience in the management of the business of other roads, much less favorably situated than this, I feel no hesitation in making this prediction. I look upon the result as one upon which there can be no doubt entertained.

The inquiry may be made, "If this Road must prove a profitable investment, why other works in Pennsylvania, favorably located, have not yielded remunerating dividends to their proprietors?" In reply, it can be stated, that there is no important work, leading from Philadelphia, that ought not now to divide large profits, if their stock and funded debts exhibited a fair cash value of the property represented. Most, if not all, of these works, were commenced with inadequate capital, for the object in view, and from the anxiety of the stockholders to realize the large profits promised on their completion, and the *public to enjoy the use* of the improvement, they have been pressed forward faster than true economy, or the funds of the Company, would justify. Engagements were made, relying upon fortune, or accident, to provide the means to meet them. These resources failing, they were thrown upon the mercy of either the contractors or the money-lender. And, in consequence, the cost of the works has been rolled up to an amount not anticipated; and, in many cases, debts incurred, under the pressure of the moment, in the most objectionable shape, to meet which the whole of the receipts of the companies have necessarily been mortgaged.

In New England, and also in New York—where rail-roads have, in many cases, been deprived of the privilege of carrying freight—judiciously located roads have invariably paid well. Their success has not been caused by the exercise of any peculiar skill, or economy in their management, as gene-

rally supposed: for, in this respect, though they stand deservedly high, there is none that conduct their business, under all the circumstances, with as much economy as the Baltimore and Ohio Rail-road, or some other southern companies.

In closing this communication, it gives me much pleasure to acknowledge the zealous and cordial co-operation that I have received from my Associate and Assistant Engineers, in carrying on the important work that you have committed to our charge.

Respectfully submitted, by

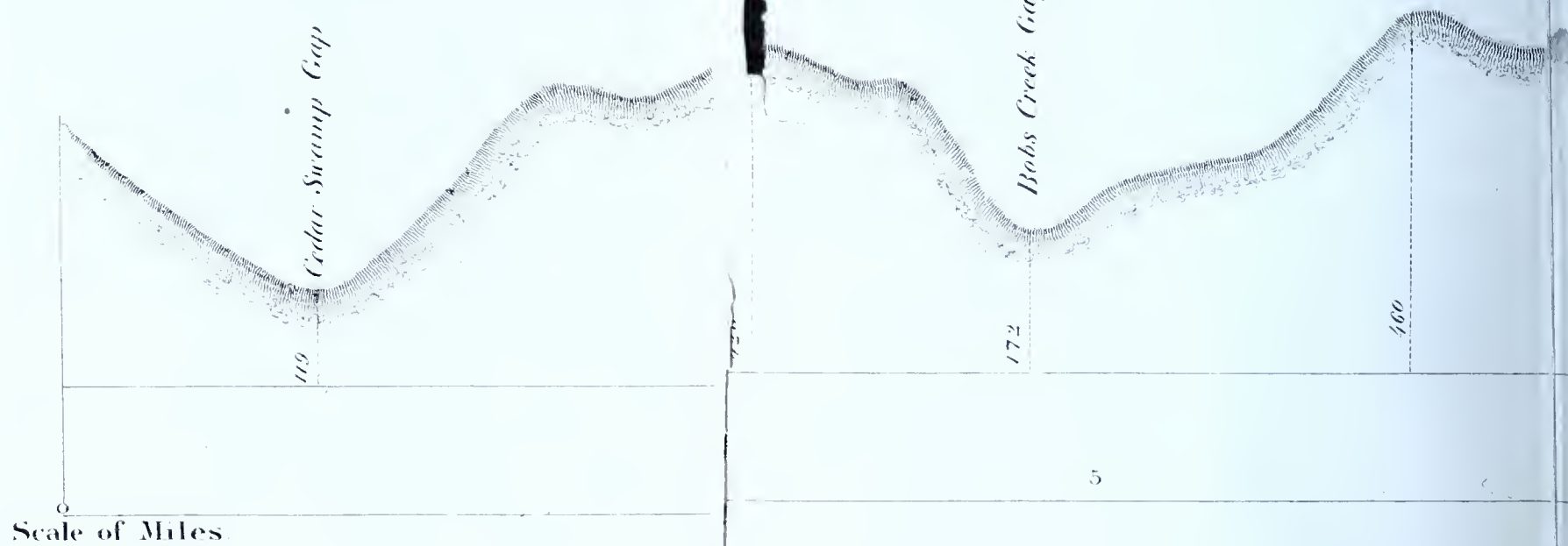
Your obedient servant,

J. EDGAR THOMSON,

*Chief Engineer.*







*Big Spring Gap*

273

360

*Laurel Gap*

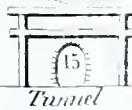
181

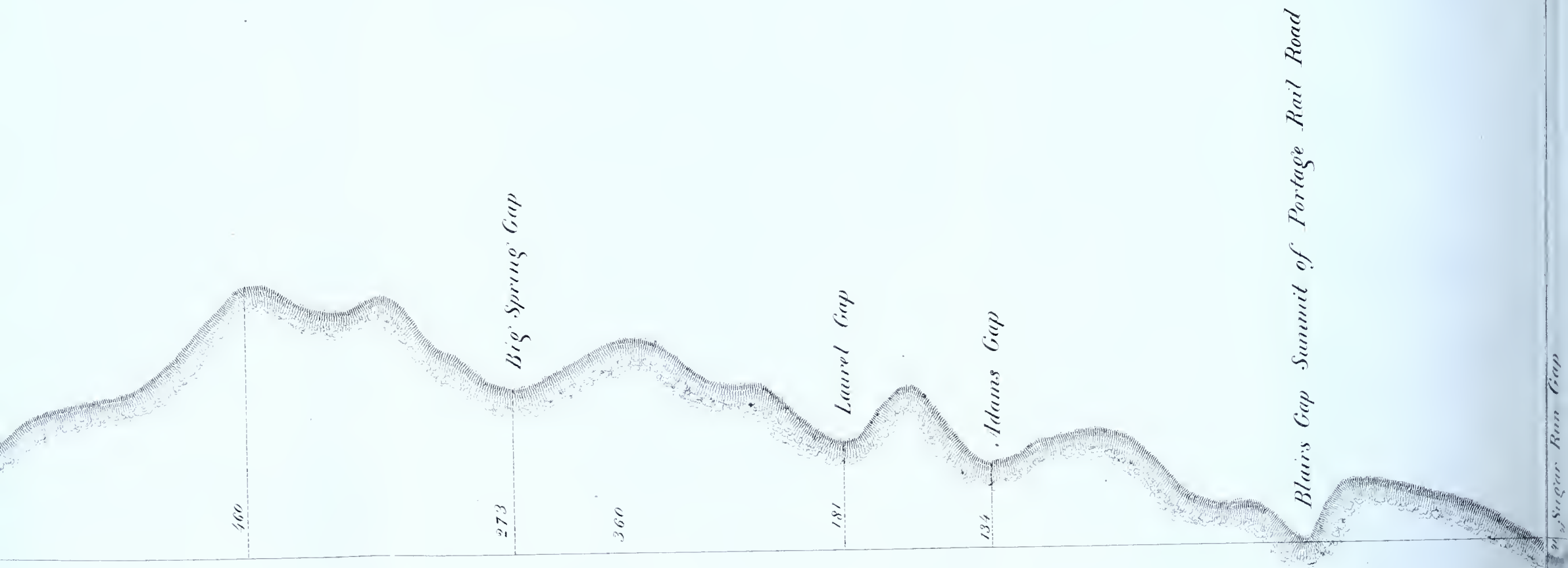
*Adams Gap*

134

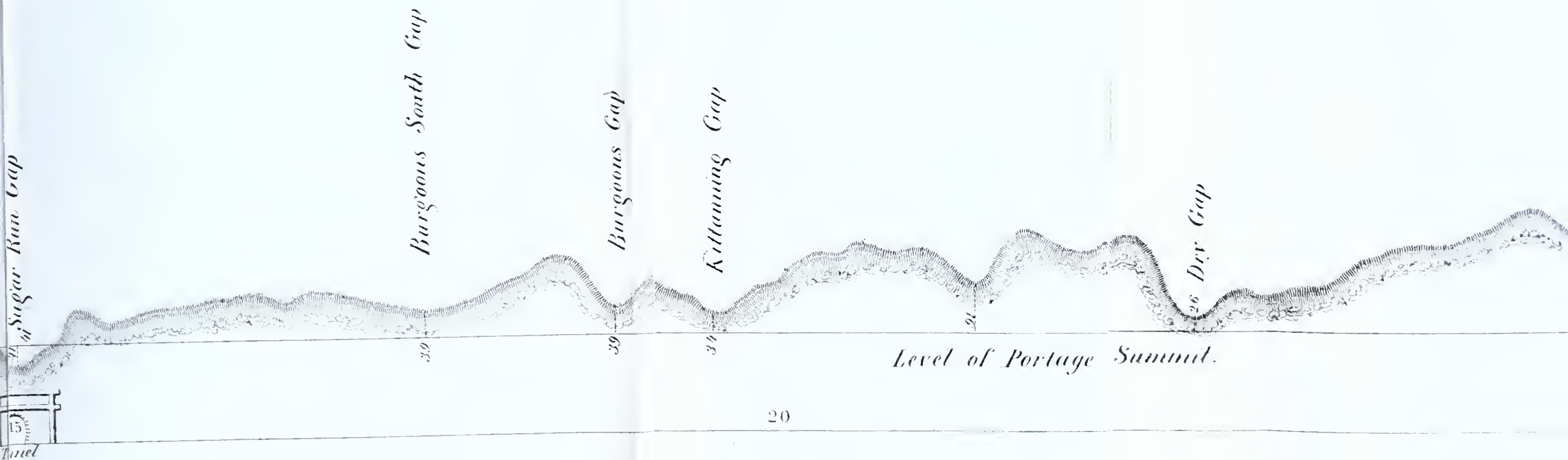
*Blairs Gap Summit of Portage Rail Road*

*Sugar Run Gap*





*Profile of the best Line of the Allegheny Mountains, from Cedar Swamp Gap to the Three  
a distance of 44 Miles*



**Level Proposed Tunnel at SUGAR RUN GAP, 160 Ft. below Portage Summit**

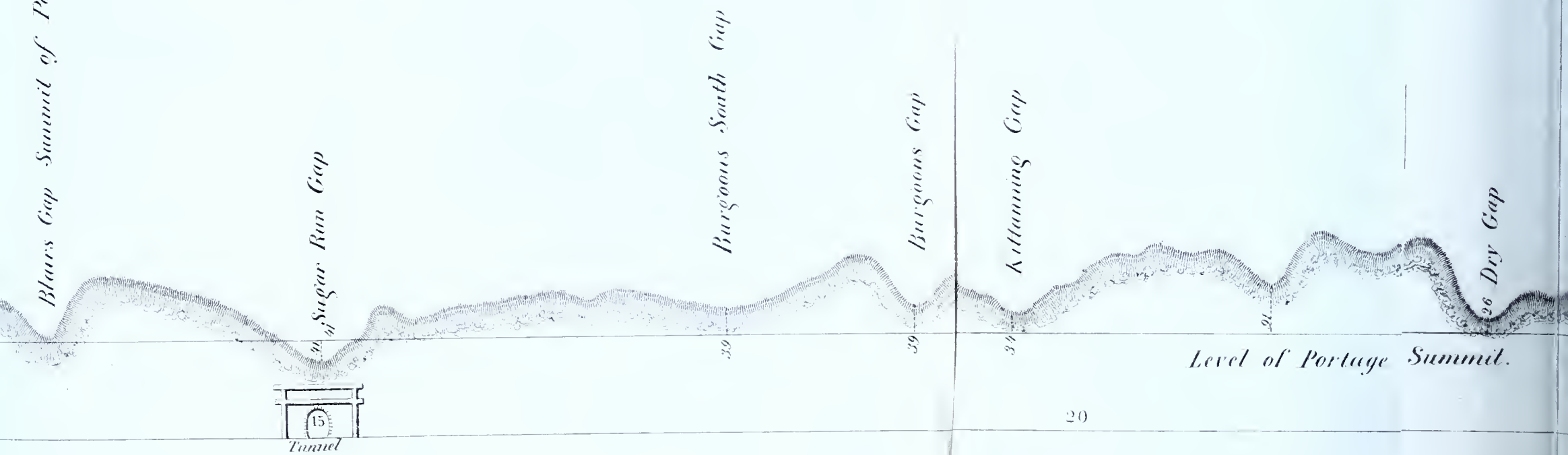
*Horizontal Scale, — 5000 Ft. to an Inch.*

*Vertical Scale, — 250 Ft. to an Inch.*



Blair's Gap Summit of Portage Rail Road

*Profile of the best Line of the Allegheny Mountains, from Cedar  
a distance of 44 Miles*



Level Proposed Tunnel at SUGAR RUN GAP, 6

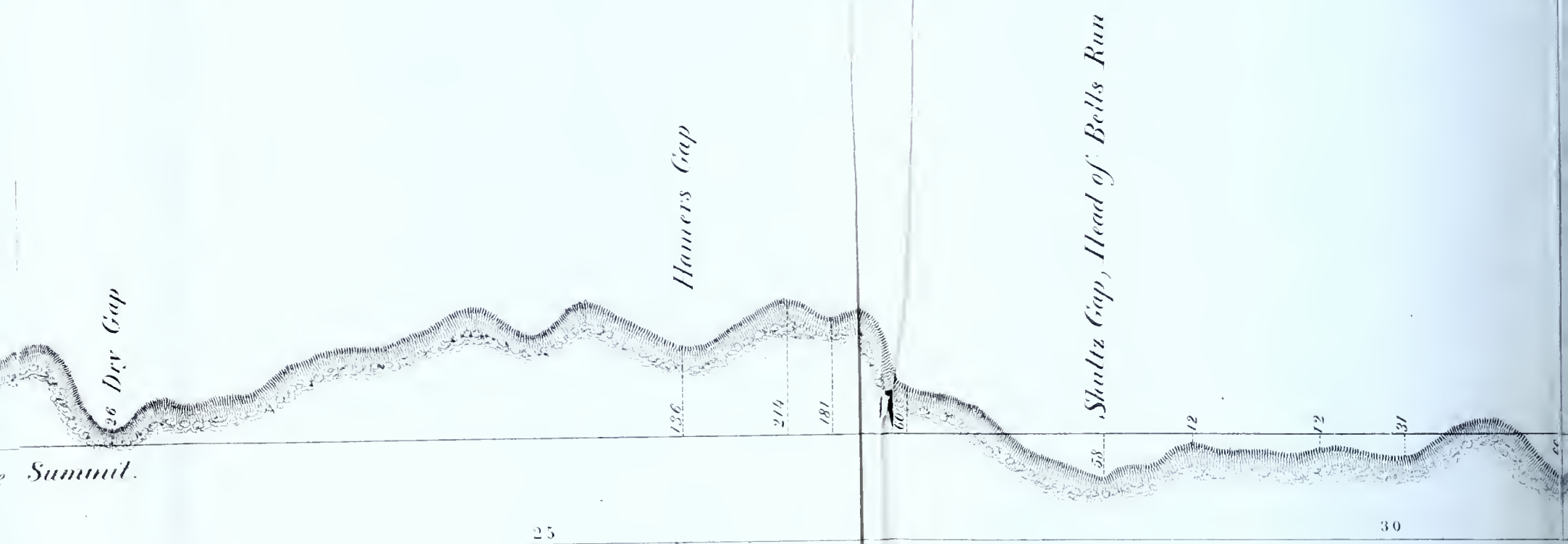
Horizontal Scale, — 5000 F<sup>t</sup> to an

Vertical Scale, — 250 F<sup>t</sup> to an





*from Cedar Swamp Gap to the Three Springs Gap.*



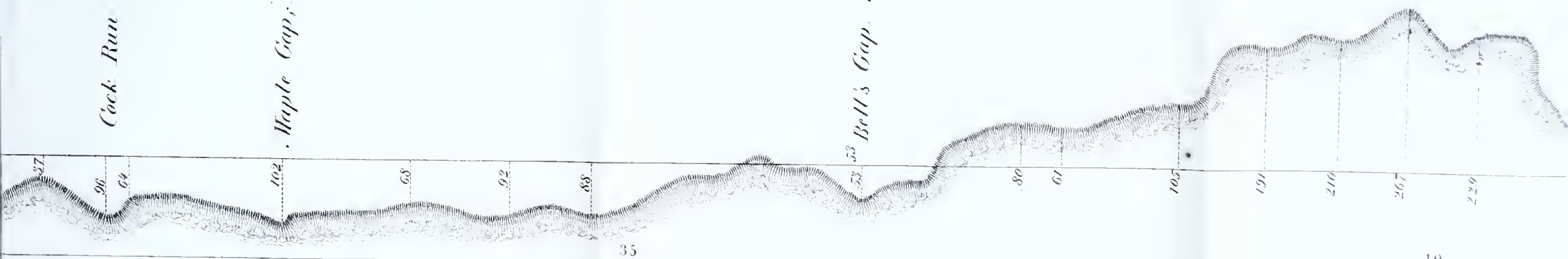
**RUN GAP, 160 Ft. below Portage Summit.**

- 5000 Ft to an Inch.
- 250 Ft to an Inch.

*Cock Run Gap*

*Maple Gap, Belts Run & Sandy Run*

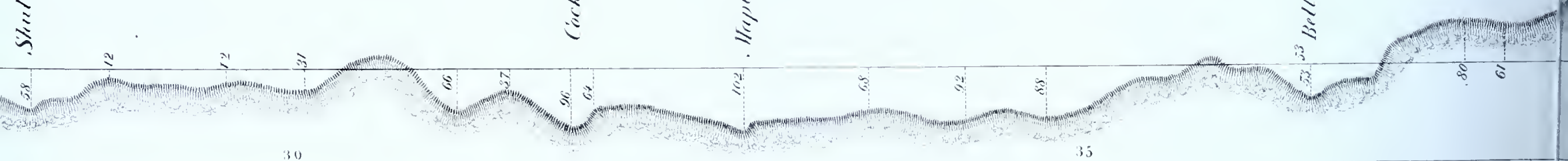
*Bell's Gap, Richards*



35

40

*Shultz Gap, Head of Bells Run*



30

35

*Cock Run Gap*

*Maple Gap, Bells Run & Sandy Run*

*Bell's Gap, Richards*

80

61

*Three Springs Gap, Tipton's Laurel Run & Moshannon*

